Millimeter Scale Magnetometer, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

This Phase I SBIR project will investigate the feasibility of a miniature atomic magnetometer, both as a stable scalar device for calibrating fluxgate magnetometers in flight and also as a vector device capable of complimenting fluxgate magnetometers. Missions to Europa will seek to confirm that moon's underground sea by measuring Europa's effect on Jupiter's magnetic field.

Meeting this science goal requires a very stable magnetometer. The helium vector-scalar magnetometer is a mature technology for this requirement, but recent work has shown that alkali vapor magnetometers can provide the needed stability with better SWAP. The proposed magnetometer is based on atomic alignment, which has high sensitivity and inherently less heading error. Also proposed is a way to operate the magnetometer that allows it to provide both vector and scalar information. Finally, the Phase I research will test the radiation hardness of the vapor cell and polarization optics. These are key components of the magnetometer that are not commonly used for other instruments, and therefore radiation data is not available for them.

Anticipated Benefits

Magnetometers are used on missions to planets and moons as well as studies of Earth's radiation system and space weather. Many of these missions would benefit from improved stability with a smaller SWAP.

Defense applications include anti-submarine applications and detecting hidden tanks, reinforced bunkers, etc. Civilian applications include oil and mineral exploration, mining, buried object detection, and the recovery of objects lost at sea. Medical applications include the measurement of the magnetic field produced by each heartbeat. Maps of this field can be used to diagnose certain common ailments.

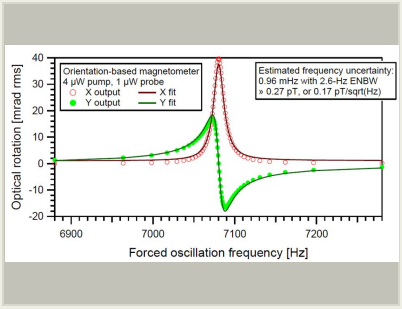

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Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

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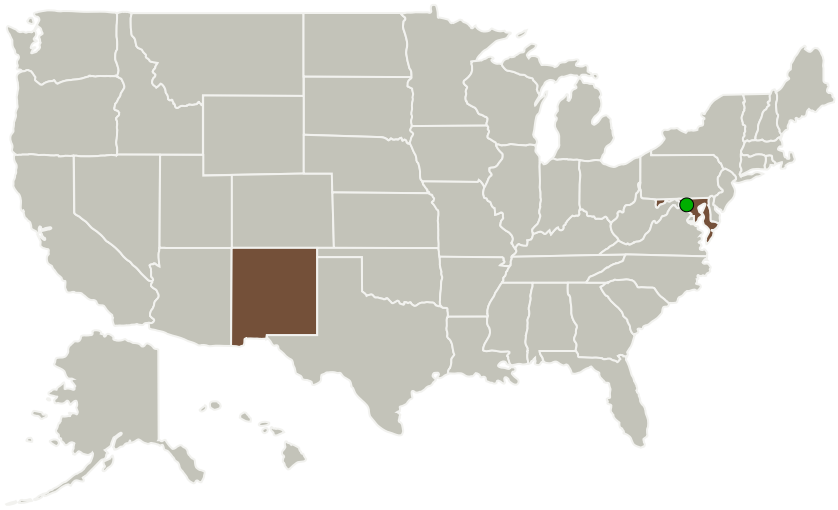
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Southwest Sciences, Inc.	Lead Organization	Industry	Santa Fe, New Mexico
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Maryland	New Mexico

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137862)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Southwest Sciences, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

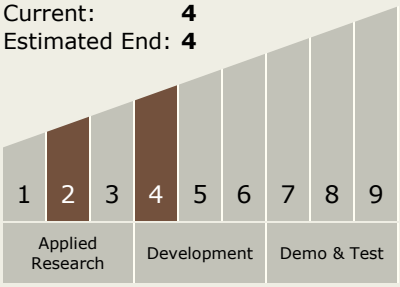
Carlos Torrez

Principal Investigator:

David C Hovde

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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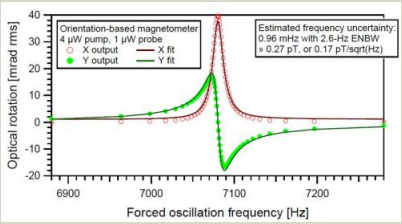
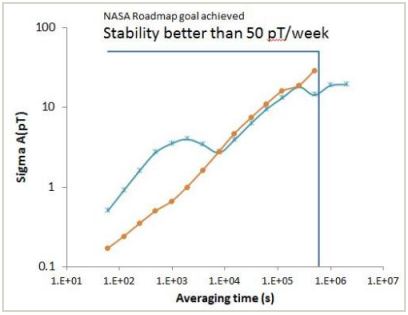
Images



Briefing Chart Image
Millimeter Scale Magnetometer, Phase I
(https://techport.nasa.gov/image/126175)



Final Summary Chart Image
Millimeter Scale Magnetometer, Phase I
(https://techport.nasa.gov/image/132165)

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.3 In-Situ Instruments and Sensors
    - TX08.3.1 Field and Particle Detectors

Target Destination

Others Inside the Solar System